

WHAT IS CLAIMED IS:

1. A vehicle steering apparatus comprising:
  - a variable gear ratio device having an input shaft coupled to a steering wheel side and an output shaft coupled to a steered wheel side, which changes a ratio of an angle input to the input shaft and an angle output to the output shaft by rotation of a motor, and
    - a lock mechanism which restricts relative rotation of the input shaft and the output shaft, the lock mechanism including i) a lock holder which is provided on a rotor side of the motor and rotates together with the rotor, and which has a plurality of first indented portions formed in a circumferential direction along a circumference thereof, and a second indented portion, which is indented even deeper than the first indented portion and is formed at one end portion of each of the first indented portions; and ii) an engaging member which is provided on a stator side of the motor and is able to move close to and away from the lock holder, and which engages with one of the first indented portions or one of the second indented portions of the lock holder when the engaging member is operated so as to move close to the lock holder.
    2. The apparatus according to claim 1, further comprising:
      - a rotation detecting device which detects a rotational position of a rotating shaft of the motor, wherein the engaging member is engaged with the first indented portion such that play therebetween is allowed to a degree where output from the rotation detecting device changes.
    3. The apparatus according to claim 2, wherein the rotation detecting device repeatedly outputs a plurality of different signals as the motor rotates, and an angle of the play when the engaging member is engaged with the first indented portion is at most a rotational angle of the motor that is necessary for all of the plurality of different signals to be output by the rotation detecting device.
    4. The apparatus according to claim 3, wherein the rotation detecting device outputs the plurality of different signals a plurality of times while the motor rotates 360 degrees.

5. The apparatus according to claim 3, wherein the motor is driven when the engaging member is engaged with the first indented portion or the second indented portion, and the apparatus detects a positional relationship between the engaging member and the lock holder based on the output signal from the rotation detecting device at that time.

10 6. The apparatus according to claim 5, wherein when the engaging member is engaged with the first indented portion or the second indented portion, the motor is rotated as far as possible first in a certain direction and then as far as possible in the opposite direction, and the apparatus determines that the engaging member is engaged with the second indented portion when a number of changes in an output pattern of the rotation detecting device when the motor is rotated in the opposite direction is less than a predetermined number.

15 7. The apparatus according to claim 5, wherein when the engaging member is engaged with the first indented portion or the second indented portion, the motor is rotated as far as possible first in a certain direction and then in the opposite direction, and the apparatus determines that the engaging member is engaged with the first indented portion when a number of changes in the output pattern of the rotation detecting device when the motor is rotated in the opposite direction is equal to, or 20 greater than, than a predetermined number.

25 8. The apparatus according to claim 3, wherein at least one of the second indented portions of the lock holder is such that an opening width in the circumferential direction thereof differs from the opening width of another second indented portion, and the motor is driven when the engaging member is engaged with the second indented portion, and the apparatus detects the engaging position of the engaging member based on the output signal from the rotation detecting device at that time.

30 9. The apparatus according to claim 8, wherein the opening widths of the second indented portions are all different.

10. The apparatus according to claim 2, wherein the motor is driven when the engaging member is engaged with the first indented portion or the second indented portion, and the apparatus detects a positional relationship of the engaging portion and the lock holder based on an output value of the rotation detecting device at that time.

5                   11. The apparatus according to claim 10, wherein when the engaging member is engaged with the first indented portion or the second indented portion, the motor is rotated as far as possible first in a certain direction and then as far as possible in the opposite direction, and the apparatus determines that the 10 engaging member is engaged with the second indented portion when a change in the output value of the rotation detecting device when the motor is rotated in the opposite direction is less than a predetermined value.

15                  12. The apparatus according to claim 10, wherein when the engaging member is engaged with the first indented portion or the second indented portion, the motor is rotated as far as possible first in a certain direction and then in the opposite direction, and the apparatus determines that the engaging member is engaged with the first indented portion when a change in the output value of the 20 rotation detecting device when the motor is rotated in the opposite direction is equal to, or greater than, a predetermined value.

25                  13. The apparatus according to claim 10, wherein at least one of the second indented portions of the lock holder is such that an opening width in the circumferential direction thereof differs from an opening width of another second indented portion, and the motor is driven when the engaging member is engaged with the second indented portion, and the apparatus detects an engaging position of the engaging member based on the output value of the rotation detecting device at that time.

30                  14. The apparatus according to claim 13, wherein the opening widths of the second indented portions are all different.

15. The apparatus according to claim 10, wherein the rotation detecting device is unable to detect a predetermined rotational angle of the rotating shaft, and is provided with respect to the lock holder so that undetectable rotational angle is set outside of a rotational range within which the engaging member engages 5 with the second indented portion of the lock holder.

16. The apparatus according to claim 1, wherein the second indented portion of the lock holder is such that an opening width thereof in the circumferential direction gradually becomes narrower in the axial direction of rotation 10 of the lock holder, and, when the engaging member is engaged with the second indented portion, the engaging member moves in a direction in which the opening width of the second indented portion narrows in the axial direction as the lock holder rotates.

15 17. The apparatus according to claim 1, wherein the engaging member is coupled to the steering wheel via the input shaft, and the lock holder is coupled to the rotating shaft.

18. A vehicle steering apparatus comprising:  
20 variable gear ratio means, which has an input shaft coupled to a steering wheel side and an output shaft coupled to a steered wheel side, for changing a ratio of an angle input to the input shaft and an angle output to the output shaft by rotation of a motor, and

25 a lock mechanism which restricts relative rotation of the input shaft and the output shaft, the lock mechanism including i) a lock holder which is provided on a rotor side of the motor and rotates together with the rotor, and which has a plurality of first indented portions formed in a circumferential direction along a circumference thereof, and a second indented portion, which is indented even deeper than the first indented portion and is formed at one end portion of each of the first 30 indented portions; and ii) an engaging member which is provided on a stator side of the motor and is able to move close to and away from the lock holder, and which engages with one of the first indented portions or one of the second indented portions of the lock holder when the engaging member is operated so as to move close to the lock holder.